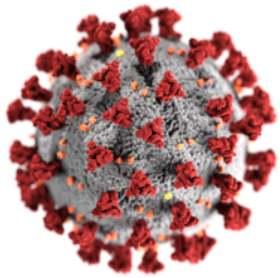
RESPIRATOR LIFESPANS



Air Filtration Mechanics

The mechanics of air filtration is complex. The efficiency of a filter depends on the rate of air flow through the filter, the humidity levels, the concentration of the various contaminants in the ambient air, the size, shape, electrical charge and other chemical and physical properties of the particle being filtered, the nature of other contaminants captured on the filter *and* the composition and condition of the filter material itself. Many of these factors can change over time and affect the filter's lifespan.

The NIOSH approval for ***N95*** filters relies on a ***performance test*** using an aerosol of very small salt (NaCl) particles, so manufacturers are given great latitude in choosing the filter material they use to meet the performance requirements. To receive an ***N95*** rating, the filter must exclude 95% of the test particles of *0.3 microns (300 nanometers)* or larger. The *N99* and *N100* filters exclude a greater percentage of such particles. 42 CFR Part 84, Subpart K, § 84.181.

How long does a N95 Respirator last?

The answer is not easy to give and depends on a number of factors. Let's consider some of them.

1. What is in the filter material of a N95 respirator?

The composition of ***N95 filter material*** varies by manufacturer. Filters are typically made with a fibrous material that can present a physical barrier to large particulates in the air. However, to catch and retain small dust particles - *in the 0.3 micron (300 nanometers) range* - they also utilize a ***statically charged*** material. This charge will dissipate over time. The charge will also be lost if the material is exposed to an oil-mist, which is why the ***N-*** rating for an ***N95*** filter indicates that it should ***not*** be used in such an environment.

2. What is the respirator being used to filter?

When the ***N95*** respirator is used as a dust mask, the filter will eventually become overloaded. This is dangerous, because it will create resistance to inhalation, and force greater amounts of contaminated air to be inhaled from around the edges of the respirator, rather than through the filter itself.

The ***Coronavirus*** is ***not*** a statically charged dust particle, and while the virus itself is small (***50 to 200 nanometers*** *in diameter*), it travels through the air on droplets produced by sneezing and coughing, which are typically ***5 microns*** (*5,000 nanometers*) or larger. The mechanics of filter use with ***Coronavirus*** has not been studied, but it probably doesn't depend on a static charge being maintained in the filter material. And, it seems unlikely the ***Coronavirus*** would accumulate on a filter in sufficient quantities to physically overload the filter, *but the virus will not be the only thing*

Use Recommendations

The manufacturers of ***N95*** respirators generally advise that the filters should be disposed of after ***8 hours*** of use, or sooner, if there is a conspicuous contamination. This is based on a non-specific use of the respirator and the fact that the static charge dissipates. **The effect that the *Coronavirus* might have on the lifespan of a filter is currently unknown.**

The ***standard shelf life*** of ***N95*** respirators is often described as a maximum of ***five years*** from production date and if it has been stored in the original packaging. This will vary according to the composition of the filter, since charcoal and other absorbents loose effectiveness over time.

HEPA Filters

A high-efficiency particulate arresting (HEPA) filter must remove 99.97% of particles whose diameter is equal to 0.3 microns. It is equivalent to a ***N100***, ***R100*** or ***P100*** filter.

Filters Used Outside U.S.

In the EU, a FFP1 half-mask filter is rated at 80% efficiency, **FFP2 is 94%,** and FFP3 is 99%. The EU also measures leakage.

The China KN95, AS/NZ P2, Korea 1st Class, and Japan DS FFRs are viewed as "equivalent" to the US NIOSH N95 and European FFP2 filtering facepiece respirators (FFR).

See, this website.

captured on the filter. Check the manufacturer's website for guidance on the lifespan of the filter material.

3. What procedure is being performed?

There are aerosol-generating procedures that pose a higher risk of exposure - *and thus contamination of the respirator* - than routine patient care activities. These include intubation, extubation, bronchoscopy, sputum induction, cardiopulmonary resuscitation, open suction of airways, nebulization, and collecting nasopharyngeal samples.

How desperate is your situation?

Its easy to advise people to dispose of the respirator after the initial use, or after 8 hours, but in these times, no one has an unlimited supply of replacements, and some may not have any at all.

1. Extending the life of a N95 respirator

There are suggestions for extending the life of N95 respirators that involve using a cheap and plentiful gauze surgical mask *over the respirator*, or a face shield, to capture the worst of the droplets carrying the virus. The surgical mask can then be disposed of more frequently. *See*, the QR Code below.

2. Can a N95 respirator be sterilized?

While it is ***never*** recommended, it would seem better to reuse a sterilized ***N95*** respirator, than be forced to use nothing at all. You must use your own judgment. Reportedly, the ***Coronavirus*** be can be easily deactivated on surfaces, with heat, bleach, various disinfectants and UV-C light, *although the same might **not** be true for other pathogens captured on the filter.* Some common healthcare pathogens have prolonged environmental survival (e.g., methicillin-resistant Staphylococcus aureus, Vancomycin-resistant enterococci, Clostridium difficile, Norovirus, etc.). If you have no better option, and choose sterilization and reuse, keep in mind the user will be breathing the disinfectant, if any remains on the filter, and you don't want to damage the filter material, so choose wisely. Hopefully, a protocol will soon be developed for worst case scenarios. Here are CDC protocols for reuse:

"**Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings**"